Petr Stepanov

Materials science. Particle simulations and data analysis. Software development.

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> **Ph.D. graduate** in physics with expertise in **materials science**, **gamma-ray spectroscopy**, **defect studies**, and nuclear physics. 7+ years of experience in **data analysis**, **particle simulations** and **software development**.

Summary of Qualifications

- More than 7 years of experience in GUI desktop software development for data analysis and statistics (C++, ROOT, Qt, Java, Python).
- Solid background in Geant4 particle simulations software. Developed Geant4-based programs for applications in high-energy physics and photonics research (EIC, NPS).
- Strong materials science skills. Defect characterization, porosity studies in bulk materials (with crystal structure and nano-powders).
- Over 5 years of hands-on experience with data acquisition setups and numerous fast electronic modules (ORTEC, Canberra, Tektronix).

Work Experience

Research Collaborator (On-Site)

Thomas Jefferson National Laboratory (JLab), Newport News, VA, USA. **Jul 2020 - Current**

- Coded a Geant4-based sumulation for studying the optimal light guide length (range 0-10 cm) for the EM calorimeter used in the Electron-Ion-Collider (EIC) project. Link to GitHub.
- Used Machine Learning (ML) techniques to perform binary classification of thousands of signals from a data acquisition (DAQ) setup. Link to GitHub.
- Applied CERN ROOT framework (C++) to perform statistical analysis of a significant amount (over 100 GB) of the raw experimental data of the Kaon LT experiment at JLab. Link to GitHub.
- Utilized SLURM supercomputer environment to run programs on the JLab supercomputer environment simultaneously. This reduced the wall time by more than 10 times.
- Proposed and implemented RAMDisk functionality on the development environment. This led to an over 50% increase in source code indexing time.
- Set up data acquisition system that performs triggered waveform acquisition involving 3 devices - Tektronix oscilloscope, Network Attached Storage, and RedHat computer (SAMBA, Python, National Instruments NI-VISA library).
- Contributed 100+ shifts at the Hall C in Thomas Jefferson Particle Accelerator facility for the Pion LT project.

Postdoctoral Researcher (Remote)

Catholic University of America (CUA), Washington, DC, USA. **Jul 2020 - Current**

- Programmed a Geant-4 computer simulation (C++, CMake, Eclipse IDE, gdb) to study performance of a novel scintillation material for EIC, Brookhaven National Lab. Link to GitHub.
- Visualized energy deposition profiles and calculated energy resolutions for variety of detector assemblies.
- Teaching experience. Mentoring students within a 3-month Research Experiences for Undergraduates (REU) program at the Physics Department at CUA. Giving talks and presentations about Linux Terminal, and supercomputer environment.
- Enhanced debugging of the core library source code led to the publishing of more than 10 bug reports on the ROOT (C++) forum.

Research Assistant

Bowling Green State University (BGSU), Bowling Green, OH, USA. **Aug 2014 - May 2020**

- Assembled positron lifetime and Doppler spectrometers from ORTEC and Canberra (Mirion) fast electronic units. Utilized High-Purity Germanium Detectors (HPGe) and scintillation-based detector systems for single-photon counting.
- Developed three open-source programs (C++, CERN ROOT) for a novel interpretation of the positron lifetime and Doppler experimental spectra.
- Derived and solved kinetic equations describing the formation and chemical reactions of e+ and Ps atoms in solids, liquids, and nano-powders (Wolfram Mathematica).

- Incorporated physical parameters (grain size, defect concentrations, rate constants) into custom models (PDFs with convolution) for fitting of the experimental spectra (RooFit).
- Above research allowed for estimation of defect concentrations and sizes in solids, classification of defect types (vacancies, dislocations) and characterization of the chemical decoration of defects.
- Wrote a GUI application LuminApp (Java, Swing) to parse and merge time-stamped data from optical spectrometer and thermometer. This increased data processing time by two orders of magnitude.
- Developed static website (Hexo, Gulp, Bootstrap) and visual identity for the SelimLab research group. The website has a 99% Google performance rank and features 700 ms time to interactive metrics.

Computer Science Skills

- **Essentials**. Git, SVN, SSH, Linux, and Terminal usage. BASH scripting. IDEs: Eclipse, Xcode, Visual Studio Code (VS Code).
- **Project management**. JIRA, Trello, GitHub, GitLab.
- **Simulation and data analysis**: Geant4, CERN ROOT, MATLAB, Wolfram Mathematica, Maple.
- **Academic writing**: LaTeX, MS Office Suite, Zotero.
- **Data plotting**: Gnuplot, OriginLab, QtiPlot, SciDaVis, Grapher.
- **Desktop app development**. C/C++, GNU make, CMake. Frameworks: Qt, CERN ROOT, Geant4. Java and Swing. Python.
- **Frontend**: HTML, CSS (LESS and SASS), Bootstrap, responsive web design, JavaScript and jQuery, npm, gulp, AngularJS, React.js. Google Web Toolkit. PHP and WordPress themes development.

Education

Bowling Green State University (BGSU) • Ohio, USA **Aug 2014 - May 2020**

Ph.D. in Photochemical Sciences • GPA 3.423. Novel developments in positron annihilation spectroscopy techniques—from experimental setups to advanced processing software. View manuscript.

Ohio Supercomputer Workshop • Ohio, USA **Jan 2017 - Feb 2017**

Hands-on sessions in Supercomputer Essentials. Introduction to the key developments in the supercomputer field.

Featured Publications

- P. S. Stepanov, F. A. Selim et al. Interaction of positronium with dissolved oxygen in liquids. *Physical Chemistry Chemical Physics* **2020**, 22 (9), 5123-5131. 10.1039/c9cp06105c.
- P. S. Stepanov, F. A. Selim et al. A model for joint processing of LT and CDB spectra of dielectric nano-sized powders. *AIP Conference Proceedings 2182* **2019**. 10.1063/1.5135836.
- P.S. Stepanov, S.V. Stepanov et al. Developing New Routine for Processing Two-Dimensional Coincidence Doppler Energy Spectra and Evaluation of Electron Subsystem Properties in Metals. *Acta Physica Polonica A* **2017**, 132 (5), 1628-1633. 10.12693/aphyspola.132.1628.

Professional Networks

- Find examples of my code on GitHub (50+ repositories).
- Discover my professional contacts on LinkedIn (200+ connections).
- Skim through the list of my publications on Google Scholar (24 articles, 200+ citations).

Interests

- Hosting an open-source project for keyboard remapping on Linux 300+ stars on GitHub.
- Contributing to the C++ open source framework ROOT. Created two shared libraries to facilitate data analysis. Links to GitHub: CanvasHelper and RootUtils.